

Books

Ground Water Monitoring Technology: Procedures, Equipment, and Applications

Robert D. Morrisson, Timco Mfg. Inc., Prairie du Sac, Wis., xv + 111 pp., 1983, \$33.

Reviewed by Kenneth R. Bradbury

Over the past few years, increased interest in groundwater monitoring has resulted in numerous new articles about, equipment for, and approaches in the field measurement of physical and chemical groundwater parameters. *Ground Water Monitoring Technology* is a useful book that attempts to make sense of this recent information by organizing it into sections on monitoring the vadose zone (part 1), monitoring the zone of saturation (part 2), and groundwater sampling equipment (part 3). According to the preface, "A degree of discrimination was exercised in selecting technologies which were directly applicable for field use." The book emphasizes "field proven methods which have been documented" at the expense of other promising but unproven field techniques, and it omits laboratory methods except where required for instrument calibration. Morrisson is aware of the rapidly changing nature of current groundwater field techniques and has written the book so that it "will be useful even after a particular instrument becomes obsolete."

Ground Water Monitoring Technology is not a "cookbook" of step-by-step instructions for field investigations, nor is it a collection of case studies. Instead, it is a compilation of various field methods, each carefully documented by references to the literature, with the emphasis on equipment rather than technique. In fact, the strength of this book is the collection of 481 references, which refer to monographs and periodicals in a number of associated scientific fields, primarily including, but not limited to, hydrogeology, hydrology, geophysics, soil science, engineering, and meteorology. These references alone are probably worth the price of the book. For each technique discussed, the author briefly describes the theory and equipment involved. The interested reader can then go to the references cited to obtain more detailed information about a particular method or item of equipment.

Part 1 of the book, dealing with monitoring in the vadose zone (53 pages; 380 references) is excellent in scope and detail, and many readers may want to purchase the book solely for this chapter. Sections on soil moisture po-

tential, soil moisture content, soil salinity, temperature, and soil pore water sampling provide a good review of "traditional" techniques such as tensiometry, moisture blocks, electrical conductivity probes, and vacuum pressure lysimeters, while introducing newer techniques such as Nuclear Magnetic Resonance and inductive electromagnetism, which may be unfamiliar to many readers. Professionals involved in contaminant monitoring will be particularly interested in the section on soil pore water sampling, which discusses how various lysimeter materials (ceramics, nylon, fused glass, Teflon) can affect the quality of water samples.

Part 2 addresses monitoring in the saturated zone (14 pages; 64 references), and includes sections on drainage systems, trench and casing lysimeters, monitoring wells, well points, well clusters, multilevel samplers, hybrid well systems (a combination of saturated and unsaturated zone monitoring), and piezometers. The strength of part 2 is its emphasis on new monitoring techniques, such as various multilevel samplers. The chapter is less adequate in its coverage of hydraulic head measurements, devoting only two pages and eight references to piezometers and monitoring techniques. In view of the extensive discussion of head measurement in the unsaturated zone and the importance of hydraulic head as the fundamental measurement in hydrogeology, these are curious omissions. In addition, there is no discussion of the applications of the various analog and digital water level recorders available today and which are often integral components of a groundwater monitoring program.

The third part of the book contains a brief but adequate (10 pages; 37 references) discussion of water sampling equipment, including bailers, various suction and submersible pumps, and packer pumps. Once again there is an emphasis on how various sampler materials (PVC, stainless steel, Teflon, etc.) can affect water sampling results. The chapter could have been improved by including one or more tables summarizing the adequacy of materials and techniques for sampling various organic and inorganic chemical constituents.

Consultants and researchers involved in groundwater contamination studies will find this book valuable. Most of the equipment described is best suited to relatively shallow investigations (on the order of a few hundred feet or less) and there is a strong emphasis on contaminant studies. Investigators interested in monitoring deeper groundwater systems or in water quantity studies may find the book less useful. The book is clearly written and well illustrated with legible drawings and

Important Professional Reading...

Ninth International Congress of Carboniferous Stratigraphy and Geology

Volume 1: Official Reports

Edited by MACKENZIE GORDON, Jr. This was the first Congress to be held in the United States and it attracted more than 900 geologists from 29 countries. Highlights of this volume include a special lecture on the Carboniferous of China, a concise summary of the tectonic evolution of the Iberian massif, a short history of the founding of the Carboniferous System, an incisive look at world energy prospects for the next two decades, an outline of the geology of the Spanish Carboniferous coalfields, and a novel treatment of detail paleobotanical comparisons between west European coal basins and the Donetz basin. \$25.00

High Sulphur Coal Exports

An International Analysis

Edited by MICHAEL M. CROW. Preface by SENATOR CHARLES PERCY and REPRESENTATIVE PAUL SIMON. The papers in this book were generated by the proceedings of the United States Senate Field Hearing and High Sulphur Coal Export Conference held in June of 1981. \$30.00

Blast Vibration Analysis

By G. A. BOLLINGER. This volume synthesizes theory and literature from seismological, geophysical, and engineering fields pertinent to blast vibrations induced by mining, quarrying, and engineering operations. \$6.95 paper

SOUTHERN ILLINOIS UNIVERSITY PRESS
P.O. Box 3697, Carbondale, Illinois 62902-3697

photographs. A glossary provides definitions of most technical terms used in the book, although a few, such as "cartesian monostat," and, surprisingly, "monitoring," are omitted. Although the publishing company (Timco) is in the business of selling groundwater monitoring equipment this book thankfully does

not promote Timco products over the products of other firms.

Kenneth R. Bradbury is with the Wisconsin Geological and Natural History Survey, Madison, WI 53706.

If available, Apply to either Dr. James M. Brooks or Dr. Mahlon C. Reusch III, Department of Oceanography, Texas A&M University, College Station, Texas 77843.

Texas A&M University is an affirmative action/equal opportunity employer.

Geoscience Data Manager and Staff/Texas A&M University. Geoscience Data Manager and Staff, Ocean Drilling Program, Texas A&M University, in assembly and monitor all of the electronic data and paper data collections produced on the drilling vessel and during subsequent shore studies, including quality control, preparation of data syntheses and documentation, response to user requests, and support of research activities. Geoscience bachelors or masters degree required. Experience in data base operations desirable. Total of three positions to be filled. Send a letter of application, resume, names of three references, and other relevant information to: Dr. Russell Merrill, Curator and Manager of Science Services, Ocean Drilling Program, P.O. Drawer 67, College Station, Texas 77843. Application deadline is June 1, 1984.

Unsub State University/Postdoctoral Position. One postdoctoral position is available in the Department of Physics and the Center for Atmospheric and Space Sciences at Utah State University. Candidates should have a Ph.D. degree in theoretical and/or experimental astrophysics/physics. Experience in the following areas will be advantageous: expertise in optical spectroscopy, theoretical modeling of the chemistry and dynamics of the stratosphere/mesosphere; theoretical modeling of the thermosphere/ionosphere. Opportunities exist to participate in stratospheric balloon research and to participate in the design and fabrication of experimental instruments and in data analysis and theoretical modeling. A comprehensive database of terrestrial conditions covering the extreme ultraviolet to the near infrared, and extending from the surface of the earth to the thermosphere, was recently acquired on a grant. The group is involved in the development of comprehensive models of the thermosphere and dynamics of the thermosphere/ionosphere. It is planned to extend the modeling work to the stratosphere and mesosphere in support of balloon measurements of key parameters.

Interested persons should submit a resume and the names of three individuals who can be contacted for reference purposes.

G.C. Torr, Department of Physics, Utah State University, UMC 41, Logan, Utah 84302.

before May 25, 1984. Salary will be commensurate with experience.

The Utah State University is located in scenic northern Utah, and is an affirmative action/equal opportunity employer.

Postdoctoral Position in Upper Atmospheric Physics. A postdoctoral position is available in the Space Physics Research Laboratory at the University of Michigan for a qualified candidate with a Ph.D. degree and experience in Upper Atmospheric Physics. The position involves the analysis of data obtained from two instruments flown on the NASA Dynamics Explorer-2 satellite. The extensive satellite data base provides detailed information of the Dynamics, Thermodynamics and Computational Structure of the Neutral Upper Atmosphere. The appointment will be for one year (renewable) and is to start in October, 1984. The applicant should identify and describe areas of his or her expertise that can support theoretical investigations in Upper Atmospheric Physics. A resume and the names of three persons knowledgeable of the applicant's experience should be forwarded to:

Dr. T.L. Killeen, Space Physics Research Lab, Department of Atmospheric and Oceanic Sciences, The University of Michigan, 2455 Hayward, Ann Arbor, MI 48100-2148.

The University of Michigan is a non-discriminatory/affirmative action employer.

Faculty Position in Planetary Sciences. A junior faculty position in the Department of Earth, Atmospheric, and Planetary Sciences at MIT is available for a recent Ph.D. graduate in the field of planetary dynamics. Applicants should have a solid background in classical celestial mechanics, as well as modern computer-aided numerical theory and should have demonstrated proficiency in attacking problems involving spin-orbit coupling and multi-body orbital evolution. Individual must have a strong interest in teaching graduate and undergraduate students.

Applicants should submit curriculum vitae, a brief statement of research interests, and names of three references to:

Dr. William F. Brice, Chairman, Earth, Atmospheric, and Planetary Sciences, 54-918, M.I.T., Cambridge, MA 02139.

Closing date: June 15, 1984.

MIT is an affirmative action/equal opportunity employer.

Massachusetts Institute of Technology, Haystack Observatory/Atmospheric Scientist. The Haystack Observatory is accepting applications for an anticipated Atmospheric Scientist position for one year period, equivalent to a post-doctoral appointment, to work in the field of upper atmospheric physics with the Millstone Hill Atmospheric Sciences Group. The scientist will participate in the analysis of data from multi-technique experimental campaigns performed under the Global Thermospheric Mapping Study program being coordinated from Millstone Hill. The applicant should have a M.S. or Ph.D. degree in a field related to upper atmosphere science and familiarity with computers, magnetic tape formats, computer graphics and display techniques. New Ph.D. preferred. Please write, enclosing resume, to:

J.T. Karaki, Assistant to the Director, Haystack Observatory, Westford, MA 01886.

MIT is an equal opportunity/affirmative action employer.

Faculty Position in Geophysics. Texas A&M University has a tenure track assistant professor position open starting in the fall of 1984. This is a new position and we will consider applications from outstanding candidates in any area of solid earth geophysics. Preference, however, will be given to individuals with backgrounds and interests in exploration geophysics, particularly in electrical and magnetic methods. The Department of Geophysics at Texas A&M currently has 17 faculty, 61 graduate students and 100 undergraduate students. The current faculty research emphasis is in the following areas: exploration geophysics, engineering geophysics, tectonophysics, internal earth structure, geosynthetics, and general geophysics. Geophysics maintains close contacts with the Ocean Drilling Program and intends to participate actively in the Continental Scientific Drilling Program. The Department has a VAX 11/780 computer and has just moved into a new building.

Applicants should send their resume and the names of three references by June 1, 1984 to E. Hoskins, Department of Geophysics, Texas A&M University, College Station, TX 77843.

Texas A&M University is an affirmative action/equal opportunity employer.

Geoscience Data Manager and Staff/Texas A&M University. Geoscience Data Manager and Staff, Ocean Drilling Program, Texas A&M University, in assembly and monitor all of the electronic data and paper data collections produced on the drilling vessel and during subsequent shore studies, including quality control, preparation of data syntheses and documentation, response to user requests, and support of research activities. Geoscience bachelors or masters degree required. Experience in data base operations desirable. Total of three positions to be filled. Send a letter of application, resume, names of three references, and other relevant information to: Dr. Russell Merrill, Curator and Manager of Science Services, Ocean Drilling Program, P.O. Drawer 67, College Station, Texas 77843. Application deadline is June 1, 1984.

Unsub State University/Postdoctoral Position. One postdoctoral position is available in the Department of Physics and the Center for Atmospheric and Space Sciences at Utah State University. Candidates should have a Ph.D. degree in theoretical and/or experimental astrophysics/physics. Experience in the following areas will be advantageous: expertise in optical spectroscopy, theoretical modeling of the chemistry and dynamics of the stratosphere/mesosphere; theoretical modeling of the thermosphere/ionosphere. Opportunities exist to participate in stratospheric balloon research and to participate in the design and fabrication of experimental instruments and in data analysis and theoretical modeling. A comprehensive database of terrestrial conditions covering the extreme ultraviolet to the near infrared, and extending from the surface of the earth to the thermosphere, was recently acquired on a grant. The group is involved in the development of comprehensive models of the thermosphere and dynamics of the thermosphere/ionosphere. It is planned to extend the modeling work to the stratosphere and mesosphere in support of balloon measurements of key parameters.

Interested persons should submit a resume and the names of three individuals who can be contacted for reference purposes.

G.C. Torr, Department of Physics, Utah State University, UMC 41, Logan, Utah 84302.

before May 25, 1984. Salary will be commensurate with experience.

The Utah State University is located in scenic northern Utah, and is an affirmative action/equal opportunity employer.

Postdoctoral Position in Upper Atmospheric Physics. A postdoctoral position is available in the Space Physics Research Laboratory at the University of Michigan for a qualified candidate with a Ph.D. degree and experience in Upper Atmospheric Physics. The position involves the analysis of data obtained from two instruments flown on the NASA Dynamics Explorer-2 satellite. The extensive satellite data base provides detailed information of the Dynamics, Thermodynamics and Computational Structure of the Neutral Upper Atmosphere. The appointment will be for one year (renewable) and is to start in October, 1984. The applicant should identify and describe areas of his or her expertise that can support theoretical investigations in Upper Atmospheric Physics. A resume and the names of three persons knowledgeable of the applicant's experience should be forwarded to:

Dr. T.L. Killeen, Space Physics Research Lab, Department of Atmospheric and Oceanic Sciences, The University of Michigan, 2455 Hayward, Ann Arbor, MI 48100-2148.

The University of Michigan is a non-discriminatory/affirmative action employer.

Faculty Position in Planetary Sciences. A junior faculty position in the Department of Earth, Atmospheric, and Planetary Sciences at MIT is available for a recent Ph.D. graduate in the field of planetary dynamics. Applicants should have a solid background in classical celestial mechanics, as well as modern computer-aided numerical theory and should have demonstrated proficiency in attacking problems involving spin-orbit coupling and multi-body orbital evolution. Individual must have a strong interest in teaching graduate and undergraduate students.

Applicants should submit curriculum vitae, a brief statement of research interests, and names of three references to:

Dr. William F. Brice, Chairman, Earth, Atmospheric, and Planetary Sciences, 54-918, M.I.T., Cambridge, MA 02139.

Closing date: June 15, 1984.

MIT is an affirmative action/equal opportunity employer.

Massachusetts Institute of Technology, Haystack Observatory/Atmospheric Scientist. The Haystack Observatory is accepting applications for an anticipated Atmospheric Scientist position for one year period, equivalent to a post-doctoral appointment, to work in the field of upper atmospheric physics with the Millstone Hill Atmospheric Sciences Group. The scientist will participate in the analysis of data from multi-technique experimental campaigns performed under the Global Thermospheric Mapping Study program being coordinated from Millstone Hill. The applicant should have a M.S. or Ph.D. degree in a field related to upper atmosphere science and familiarity with computers, magnetic tape formats, computer graphics and display techniques. New Ph.D. preferred. Please write, enclosing resume, to:

J.T. Karaki, Assistant to the Director, Haystack Observatory, Westford, MA 01886.

MIT is an equal opportunity/affirmative action employer.

Faculty Position in Geophysics. Texas A&M University has a tenure track assistant professor position open starting in the fall of 1984. This is a new position and we will consider applications from outstanding candidates in any area of solid earth geophysics. Preference, however, will be given to individuals with backgrounds and interests in exploration geophysics, particularly in electrical and magnetic methods. The Department of Geophysics at Texas A&M currently has 17 faculty, 61 graduate students and 100 undergraduate students. The current faculty research emphasis is in the following areas: exploration geophysics, engineering geophysics, tectonophysics, internal earth structure, geosynthetics, and general geophysics. Geophysics maintains close contacts with the Ocean Drilling Program and intends to participate actively in the Continental Scientific Drilling Program. The Department has a VAX 11/780 computer and has just moved into a new building.

Applicants should send their resume and the names of three references by June 1, 1984 to E. Hoskins, Department of Geophysics, Texas A&M University, College Station, TX 77843.

Texas A&M University is an affirmative action/equal opportunity employer.

Geoscience Data Manager and Staff/Texas A&M University. Geoscience Data Manager and Staff, Ocean Drilling Program, Texas A&M University, in assembly and monitor all of the electronic data and paper data collections produced on the drilling vessel and during subsequent shore studies, including quality control, preparation of data syntheses and documentation, response to user requests, and support of research activities. Geoscience bachelors or masters degree required. Experience in data base operations desirable. Total of three positions to be filled. Send a letter of application, resume, names of three references, and other relevant information to: Dr. Russell Merrill, Curator and Manager of Science Services, Ocean Drilling Program, P.O. Drawer 67, College Station, Texas 77843. Application deadline is June 1, 1984.

Unsub State University/Postdoctoral Position. One postdoctoral position is available in the Department of Physics and the Center for Atmospheric and Space Sciences at Utah State University. Candidates should have a Ph.D. degree in theoretical and/or experimental astrophysics/physics. Experience in the following areas will be advantageous: expertise in optical spectroscopy, theoretical modeling of the chemistry and dynamics of the stratosphere/mesosphere; theoretical modeling of the thermosphere/ionosphere. Opportunities exist to participate in stratospheric balloon research and to participate in the design and fabrication of experimental instruments and in data analysis and theoretical modeling. A comprehensive database of terrestrial conditions covering the extreme ultraviolet to the near infrared, and extending from the surface of the earth to the thermosphere, was recently acquired on a grant. The group is involved in the development of comprehensive models of the thermosphere and dynamics of the thermosphere/ionosphere. It is planned to extend the modeling work to the stratosphere and mesosphere in support of balloon measurements of key parameters.

Interested persons should submit a resume and the names of three individuals who can be contacted for reference purposes.

G.C. Torr, Department of Physics, Utah State University, UMC 41, Logan, Utah 84302.

before May 25, 1984. Salary will be commensurate with experience.

The Utah State University is located in scenic northern Utah, and is an affirmative action/equal opportunity employer.

Postdoctoral Position in Upper Atmospheric Physics. A postdoctoral position is available in the Space Physics Research Laboratory at the University of Michigan for a qualified candidate with a Ph.D. degree and experience in Upper Atmospheric Physics. The position involves the analysis of data obtained from two instruments flown on the NASA Dynamics Explorer-2 satellite. The extensive satellite data base provides detailed information of the Dynamics, Thermodynamics and Computational Structure of the Neutral Upper Atmosphere. The appointment will be for one year (renewable) and is to start in October, 1984. The applicant should identify and describe areas of his or her expertise that can support theoretical investigations in Upper Atmospheric Physics. A resume and the names of three persons knowledgeable of the applicant's experience should be forwarded to:

Dr. T.L. Killeen, Space Physics Research Lab, Department of Atmospheric and Oceanic Sciences, The University of Michigan, 2455 Hayward, Ann Arbor, MI 48100-2148.

The University of Michigan is a non-discriminatory/affirmative action employer.

Faculty Position in Planetary Sciences. A junior faculty position in the Department of Earth, Atmospheric, and Planetary Sciences at MIT is available for a recent Ph.D. graduate in the field of planetary dynamics. Applicants should have a solid background in classical celestial mechanics, as well as modern computer-aided numerical theory and should have demonstrated proficiency in attacking problems involving spin-orbit coupling and multi-body orbital evolution. Individual must have a strong interest in teaching graduate and undergraduate students.

Applicants should submit curriculum vitae, a brief statement of research interests, and names of three references to:

Dr. William F. Brice, Chairman, Earth, Atmospheric, and Planetary Sciences, 54-918, M.I.T., Cambridge, MA 02139.

Closing date: June 15, 1984.

MIT is an affirmative action/equal opportunity employer.

Massachusetts Institute of Technology, Haystack Observatory/Atmospheric Scientist. The Haystack Observatory is accepting applications for an anticipated Atmospheric Scientist position for one year period, equivalent to a post-doctoral appointment, to work in the field of upper atmospheric physics with the Millstone Hill Atmospheric Sciences Group. The scientist will participate in the analysis of data from multi-technique experimental campaigns performed under the Global Thermospheric Mapping Study program being coordinated from Millstone Hill. The applicant should have a M.S. or Ph.D. degree in a field related to upper atmosphere science and familiarity with computers, magnetic tape formats, computer graphics and display techniques. New Ph.D. preferred. Please write, enclosing resume, to:

J.T. Karaki, Assistant to the Director, Haystack Observatory, Westford, MA 01886.

MIT is an equal opportunity/affirmative action employer.

Faculty Position in Geophysics. Texas A&M University has a tenure track assistant professor position open starting in the fall of 1984. This is a new position and we will consider applications from outstanding candidates in any area of solid earth geophysics. Preference, however, will be given to individuals with backgrounds and interests in exploration geophysics, particularly in electrical and magnetic methods. The Department of Geophysics at Texas A&M currently has 17 faculty, 61 graduate students and 100 undergraduate students. The current faculty research emphasis is in the following areas: exploration geophysics, engineering geophysics, tectonophysics, internal earth structure, geosynthetics, and general geophysics. Geophysics maintains close contacts with the Ocean Drilling Program and intends to participate actively in the Continental Scientific Drilling Program. The Department has a VAX 11/780 computer and has just moved into a new building.

Applicants should send their resume and the names of three references by June 1, 1984 to E. Hoskins, Department of Geophysics, Texas A&M University, College Station, TX 77843.

Texas A&M University is an affirmative action/equal opportunity employer.

Geoscience Data Manager and Staff/Texas A&M University. Geoscience Data Manager and Staff, Ocean Drilling Program, Texas A&M University, in assembly and monitor all of the electronic data and paper data collections produced on the drilling vessel and during subsequent shore studies, including quality control, preparation of data syntheses and documentation, response to user requests, and support of research activities. Geoscience bachelors or masters degree required. Experience in data base operations desirable. Total of three positions to be filled. Send a letter of application, resume, names of three references, and other relevant information to: Dr. Russell Merrill, Curator and Manager of Science Services, Ocean Drilling Program, P.O. Drawer 67, College Station, Texas 77843. Application deadline is June 1, 1984.

Unsub State University/Postdoctoral Position. One postdoctoral position is available in the Department of Physics and the Center for Atmospheric and Space Sciences at Utah State University. Candidates should have a Ph.D. degree in theoretical and/or experimental astrophysics/physics. Experience in the following areas will be advantageous: expertise in optical spectroscopy, theoretical modeling of the chemistry and dynamics of the stratosphere/mesosphere; theoretical modeling of the thermosphere/ionosphere. Opportunities exist to participate in stratospheric balloon research and to participate in the design and fabrication of experimental instruments and in data analysis and theoretical modeling. A comprehensive database of terrestrial conditions covering the extreme ultraviolet to the near infrared, and extending from the surface of the earth to the thermosphere, was recently acquired on a grant. The group is involved in the development of comprehensive models of the thermosphere and dynamics of the thermosphere/ionosphere. It is planned to extend the modeling work to the stratosphere and mesosphere in support of balloon measurements of key parameters.

Interested persons should submit a resume and the names of three individuals who can be contacted for reference purposes.

G.C. Torr, Department of Physics, Utah State University, UMC 41, Logan, Utah 84302.

before May 25, 1984. Salary will be commensurate with experience.

The Utah State University is located in scenic northern Utah, and is an affirmative action/equal opportunity employer.

Postdoctoral Position in Upper Atmospheric Physics. A postdoctoral position is available in the Space Physics Research Laboratory at the University of Michigan for a qualified candidate with a Ph.D. degree and experience in Upper Atmospheric Physics. The position involves the analysis of data obtained from two instruments flown on the NASA Dynamics Explorer-2 satellite. The extensive satellite data base provides detailed information of the Dynamics, Thermodynamics and Computational Structure of the Neutral Upper Atmosphere. The appointment will be for one year (renewable) and is to start in October, 1984. The applicant should identify and describe areas of his or her expertise that can support theoretical investigations in Upper Atmospheric Physics. A resume and the names of three persons knowledgeable of the applicant's experience should be forwarded to:

Dr. T.L. Killeen, Space Physics Research Lab, Department of Atmospheric and Oceanic Sciences, The University of Michigan, 2455 Hayward, Ann Arbor, MI 48100-2148.

The University of Michigan is a non-discriminatory/affirmative action employer.

Faculty Position in Planetary Sciences. A junior faculty position in the Department of Earth, Atmospheric, and Planetary Sciences at MIT is available for a recent Ph.D. graduate in the field of planetary dynamics. Applicants should have a solid background in classical celestial mechanics, as well as modern computer-aided numerical theory and should have demonstrated proficiency in attacking problems involving spin-orbit coupling and multi-body orbital evolution. Individual must have a strong interest in teaching graduate and undergraduate students.

Applicants should submit curriculum vitae, a brief statement of research interests, and names of three references to:

Dr. William F. Brice, Chairman, Earth, Atmospheric, and Planetary Sciences, 54-918, M.I.T., Cambridge, MA 02139.

Closing date: June 15, 1984.

MIT is an affirmative action/equal opportunity employer.

Massachusetts Institute of Technology, Haystack Observatory/Atmospheric Scientist. The Haystack Observatory is accepting applications for an anticipated Atmospheric Scientist position for one year period, equivalent to a post-doctoral appointment, to work in the field of upper atmospheric physics with the Millstone Hill Atmospheric Sciences Group. The scientist will participate in the analysis of data from multi-technique experimental campaigns performed under the Global Thermospheric Mapping Study program being coordinated from Millstone Hill. The applicant should have a M.S. or Ph.D. degree in a field related to upper atmosphere science and familiarity with computers, magnetic tape formats, computer graphics and display techniques. New Ph.D. preferred. Please write, enclosing resume, to:

J.T. Karaki, Assistant to the Director, Haystack Observatory, Westford, MA 01886.

MIT is an equal opportunity/affirmative action employer.

Faculty Position in Geophysics. Texas A&M University has a tenure track assistant professor position open starting in the fall of 1984. This is a new position and we will consider applications from outstanding candidates in any area of solid earth geophysics. Preference, however, will be given to individuals with backgrounds and interests in exploration geophysics, particularly in electrical and magnetic methods. The Department of Geophysics at Texas A&M currently has 17 faculty, 61 graduate students and 100 undergraduate students. The current faculty research emphasis is in the following areas: exploration geophysics, engineering geophysics, tectonophysics, internal earth structure, geosynthetics, and general geophysics. Geophysics maintains close contacts with the Ocean Drilling Program and intends to participate actively in the Continental Scientific Drilling Program. The Department has a VAX 11/780 computer and has just moved into a new building.

Applicants should send their resume and the names of three references by June 1, 1984 to E. Hoskins, Department of Geophysics, Texas A&M University, College Station, TX 77843.

Texas A&M University is an affirmative action/equal opportunity employer.

Geoscience Data Manager and Staff/Texas A&M University. Geoscience Data Manager and Staff, Ocean Drilling Program, Texas A&M University, in assembly and monitor all of the electronic data and paper data collections produced on the drilling vessel and during subsequent shore studies, including quality control, preparation of data syntheses and documentation, response to user requests, and support of research activities. Geoscience bachelors or masters degree required. Experience in data base operations desirable. Total of three positions to be filled. Send a letter of application, resume, names of three references, and other relevant information to: Dr. Russell Merrill, Curator and Manager of Science Services, Ocean Drilling Program, P.O. Drawer 67, College Station, Texas 77843. Application deadline is June 1, 1984.

Unsub State University/Postdoctoral Position. One postdoctoral position is available in the Department of Physics and the Center for Atmospheric and Space Sciences at Utah State University. Candidates should have a Ph.D. degree in theoretical and/or experimental astrophysics/physics. Experience in the following areas will be advantageous: expertise in optical spectroscopy, theoretical modeling of the chemistry and dynamics of the stratosphere/mesosphere; theoretical modeling of the thermosphere/ionosphere. Opportunities exist to participate in stratospheric balloon research and to participate in the design and fabrication of experimental instruments and in data analysis and theoretical modeling. A comprehensive database of terrestrial conditions covering the extreme ultraviolet to the near infrared, and extending from the surface of the earth to the thermosphere, was recently acquired on a grant. The group is involved in the development of comprehensive models of the thermosphere and dynamics of the thermosphere/ionosphere. It is planned to extend the modeling work to the stratosphere and mesosphere in support of balloon measurements of key parameters.

Interested persons should submit a resume and the names of three individuals who can be contacted for reference purposes.

G.C. Torr, Department of Physics, Utah State University, UMC 41, Logan, Utah 84302.

before May 25, 1984. Salary will be commensurate with experience.

The Utah State University is located in scenic northern Utah, and is an affirmative action/equal opportunity employer.

Postdoctoral Position in Upper Atmospheric Physics. A postdoctoral position is available in the Space Physics Research Laboratory at the University of Michigan for a qualified candidate with a Ph.D. degree and experience in Upper Atmospheric Physics. The position involves the analysis of data obtained from two instruments flown on the NASA Dynamics Explorer-2 satellite. The extensive satellite data base provides detailed information of the Dynamics, Thermodynamics and Computational Structure of the Neutral Upper Atmosphere. The appointment will be for one year (renewable) and is to start in October, 1984. The applicant should identify and describe areas of his or her expertise that can support theoretical investigations in Upper Atmospheric Physics. A resume and the names of three persons knowledgeable of the applicant's experience should be forwarded to:

Dr. T.L. Killeen, Space Physics Research Lab, Department of Atmospheric and Oceanic Sciences, The University of Michigan, 2455 Hayward, Ann Arbor, MI 48100-2148.

The University of Michigan is a non-discriminatory/affirmative action employer.

Faculty Position in Planetary Sciences. A junior faculty position in the Department of Earth, Atmospheric, and Planetary Sciences at MIT is available for a recent Ph.D. graduate in the field of planetary dynamics. Applicants should have a solid background in classical celestial mechanics, as well as modern computer-aided numerical theory and should have demonstrated proficiency in attacking problems involving spin-orbit coupling and multi-body orbital evolution. Individual must have a strong interest in teaching graduate and undergraduate students.

Applicants should submit curriculum vitae, a brief statement of research interests, and names of three references to:

Dr. William F. Brice, Chairman, Earth, Atmospheric, and Planetary Sciences, 54-918, M.I.T., Cambridge, MA 02139.

Closing date: June 15, 1984.

MIT is an affirmative action/equal opportunity employer.

Massachusetts Institute of Technology, Haystack Observatory/Atmospheric Scientist. The Haystack Observatory is accepting applications for an anticipated Atmospheric Scientist position for one year period, equivalent to a post-doctoral appointment, to work in the field of upper atmospheric physics with the Millstone Hill Atmospheric Sciences Group. The scientist will participate in the analysis of data from multi-technique experimental campaigns performed under the Global Thermospheric Mapping Study program being coordinated from Millstone Hill. The applicant should have a M.S. or Ph.D. degree in a field related to upper atmosphere science and familiarity with computers, magnetic tape formats, computer graphics and display techniques. New Ph.D. preferred. Please write, enclosing resume, to:

University of Arizona/Tandem Accelerator Mass Spectrometry. A position is available for a junior or experienced postdoctoral scientist at the National Science Foundation Facility for Radiocarbon Analysis at the University of Arizona. The facility is used primarily to detect and analyze the presence of ^{14}C . The position involves the use of the facility for research on a variety of scientific problems, and for research on applications of accelerator mass spectrometry. Half of the time of the facility is reserved for collaboration with off-site users, and the other half is used for in-house research programs. The person hired for this position will be responsible for physical aspects of the tandem accelerator and associated equipment, and will have the opportunity to develop research programs utilizing the facility. Salary will be commensurate with experience. Available now. Contact Professor D. J. Donahue, Department of Physics, University of Arizona, Tucson, Arizona 85721 (520/921-2400).

The University of Arizona is an equal opportunity/affirmative action employer.

Southwest Research Institute/Ion Mass Spectrometry. A senior staff position is available in the Southwest Research Institute's Department of Space Sciences for a Ph.D. level experimental physicist to work in space-borne ion mass spectrometry. The successful applicant will have the opportunity to develop ion mass spectrometers for spacecraft missions in the earth's magnetosphere as well as to conduct planetary magnetospheric research. The position requires significant experience in magnetic ion mass spectrometry and in microchannel-plate imaging detector systems. Contact J.L. Burch, Southwest Research Institute, P.O. Drawer 28810, San Antonio, TX 78284, telephone 512/484-5111, extension 2528, or Bill Chutaleu, Personnel Department, extension 2072.

STUDENT OPPORTUNITIES

Special Doctoral Research Assistantships. The Department of Oceanography of Old Dominion University has several special doctoral research assistantships available for Fall Semester, 1984 and 1985. These carry a stipend of \$7,000 per academic year, renewable for three years. Applicants with M.S. degrees qualify for waiver of tuition. Students interested in studying the Ph.D. in the areas of biological, chemical, geological, or physical oceanography should send an introductory resume to Dr. Ronald E. Johnson, Graduate Program Director, Department of Oceanography, Old Dominion University, Norfolk, VA 23508.

Old Dominion University is an affirmative action equal opportunity institution.

SERVICES, SUPPLIES, COURSES, AND ANNOUNCEMENTS

Optical Aeronomy Workshop II

The second annual workshop on ground-based optical astronomy will be held in Ann Arbor, Michigan, this summer on 20-22 June, 1984. Two topics, optical detector technology and possible ways and means for improved applications of theoretical models, will be the central issues of this meeting. A total of 11 invited papers covering various types of optical detectors and their applications will be presented on the 20th, and similarly, another set of 10 to 12 invited papers on theoretical topics will be given on the 21st. There will be adequate time provided for discussion throughout the two sessions. These two areas will be reviewed by panel discussions on the morning of June 22. Some travel support will be available. Please write to Mrs. Joan Eadie, University Extension Service, University of Michigan, Ann Arbor, Michigan 48109, for details.

Dr. John Meriwether
Space Physics Research Laboratory
University of Michigan
Ann Arbor, Michigan 48109.

IS AGU IN YOUR WILL?

By adding a single paragraph, "In bequeath to the American Geophysical Union..."

- you help ensure the future of geophysics
- you have continued use of your resources during your life time
- you are likely to have real tax advantages

A bequest may be any of these:

- a tiny residual fraction of your estate
- a fixed amount of money specified securities
- proceeds of a life insurance policy

For further information write
AGU GIFT Fund
Sponsoring Committee
2000 Florida Avenue, N.W.
Washington, DC 20009

AGU MEMBERS

Does your library subscribe to the Geodynamics Series?

Meetings

Announcements

Nuclear Waste Management

November 28-29, 1984 Symposium on the Scientific Basis for Nuclear Waste Management, Boston, Mass. Sponsor: Materials Research Society. (John Stone, E. I. du Pont de Nemours and Co., Savannah River Laboratory, Aiken, SC 29808).

Abstracts for contributed papers are due June 15, 1984.

The symposium on nuclear waste management is one of 17 that will take place at the Fall Meeting of the Materials Research Society. A program of one- and two-day short

courses will complement the science and technology presented in these symposia.

Landslide and Flash Flood Hazards

June 14-15, 1984 Conference on Delineation of Landslide, Flash Flood, and Debris Flow Hazards in Utah, Logan, Utah. Sponsors: Utah Water Research Laboratory, Utah State Univ., Utah Geological and Mineral Survey, National Research Council Committee on Natural Disasters, and Utah Science and Technology Council. (David Bowles, Utah Water Research Laboratory, Utah State University, UMC 82, Logan, UT 84322.)

This specialty conference is intended to assemble descriptive information about land-

slides and debris flows in Utah that caused more than \$240 million worth of damages in the spring of 1983 alone. The conference is a forum for scientists and engineers to exchange data so that they may be better prepared for these destructive events in the future.

Papers will be presented during the conference on quantitative methods for mapping flood, debris, and landslide risks below mountain slopes, and on monitoring programs and warning systems for these hazards. Specific topics to be discussed include: soil and water conditions that lead to landslides and debris flows, instrumentation for hazard monitoring, damage analysis and cleanup, land use in hazard areas, frequency analysis of debris flow events, and social, political, and legal aspects of emergency and remedial programs.

Jacob Rubin, Morton J. Rubin, William B. F. Ryan.

Michael Schmitz, Stephen M. Scott, Alan H. Shapley, Margaret A. Shea, Norman H. Sleep, Joseph V. Smith, Kenneth G. Spengler, F. N. Spiess, Thomas W. Stern, Edward C. Stone, Glenn E. Stout, Verne E. Suomi, George H. Sutton, Kendall L. Svendsen, Lynn R. Sykes, Manik Talwani, Charles V. Theis, George A. Thompson, Edward P. Todd, M. Nafi Toksoz, James W. Tucker, Richard P. Turco, Rob Van Der Voort, John W. Vanderwolf, Pierre Verdel, James I. Vette, Clyde Wahrhaftig, James R. Wallis, Martin Wall, Harvey O. Wesby, Fred D. White, Loren D. Wicks, Owen W. Williams, Abel Wolman, Oliver R. Wulff, Gordon A. Young, John M. Zeigler.

Organizations

Many organizations show their support of the objectives of AGU through supporting membership in one of the following categories (1984 rates):

Sustaining Members \$2,400
Contributing Members \$1,200
Supporting Members \$400

Such affiliation is the company's public avowal that it is committed to the support of the objectives of the Union and to the fulfillment of the needs of its scientific staff.

Contributing Members

Chevron Oil Field Research Company
IBM
Shell Development Company

Supporting Members

Aerospace Corporation
Amoco Production Company
Bell Laboratories
Exxon Corporation
Exxon Production Research Company
Gulf Research & Development Company
Institut für Meteorologie und Geophysik, Universität Innsbruck
Kerr-McGee Corporation
Kinematic, Inc.
Lockheed Aircraft, Missiles and Space Division
Marathon Oil Company
McDonnell-Douglas Astronautics Company
Phillips Petroleum Company
Schonsted Instrument Company
Teledyne/Geotek Division
Texaco, Inc.
TRW, Inc./TRW Systems Group
UCAR
Western Geophysical Company

AGU Membership Applications

Applications for membership have been received from the following individuals. The letter after the name denotes the proposed primary section affiliation.

Mark R. Abbott (O), Paul M. Beale (V), John D. Bicknell (T), Donald F. Boesch (O), Douglas B. Boudra (O), Joe Bush (O), Ibrahim Cemen (T), Lawrence W. Ghyo (O), Roger Colony (A), John E. Cromwell (O), Alfred T. Dengler (O), Steven J. Elsenreich, Rudolf J. Engelmann (O), Jonathan Erez (O), John D. Fitz Gerald (T), Michael H. Freilich (O), John J. Garrity, Walter J. Grabowski (O), Paul Gregorius (S), Jack S. Grove (O), Peter Gues (A).

Chris M. Hawkins (O), Joseph G. Hirschberg (O), Dan Hau (O), Camilla L. Ingraham, Martin T. Kalcic (GP), Jeffrey Kerling (O), Dana R. Kester (O), Robert P. LaBelle

(O), William Lang (O), Dawn L. Lavoie (V), Dennis M. Lavoie (O), Alfred C. Leonard (H), Wen-Quan Li (O), James Lühr (V).

A. James MacDonald (V), Michael J. McCormick (O), Adele Milne (O), Gil Minkes (O), Joan R. Mitchell (O), Ashraf A. Mongroo (A), Francis F. Mueller (O), Terry A. Nelson (O), T. A. K. Pillai (O), Lawrence R. Pomeroy (O), J. W. Powell (O).

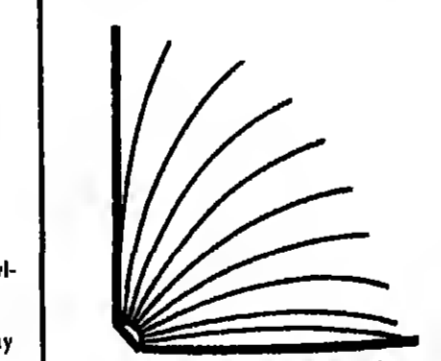
Kenneth J. Quinn (H), George T. Reynolds (O), Sergio Rubinstein (O), William B. Samuels (O), John R. Schwartz (O), Clarence H. Skau (H), Christof Stork (S), Erik Tengstrom (O), Albert E. Thieberger (O), James Thomas, Mohammad Untung (T), Henry A. Walker, Alan Weinstein (O), Dietrich Werner (T), Charlene V. Williams (O), Jan Victor Witter (H), Gui-Hai Zhu (O).

Student Status

Roger Aines (V), Bruce Baird (O), John A. Barth (O), Sara Louise Bennett (O), Roger B. Bewig (O), David C. Brewster (O), Michael E. Caughey (O), M. A. Cantka (O), Terrence A. Houlahan (O), Barbara Howell (O), Nenad Ilicic (O).

Barbara Kerschner (O), Dave Kieber (O), Isaiou Kouadin (O), Carla Lacrua (O), Kenneth S. Parker (O), Christof Pavlicki (T), Andrew Roedel (O), Robert F. Salmon (H), Alaa L. Shanks (O), William Stahner (O), Alan M. Swillenhant (O), Pagan Tour (O), Kenneth Voss (O), Scott H. Werdin (SS).

Yours for the Asking



PUBLICATIONS CATALOG

1-9-8-4

Your own guide to AGU's current selection of books and periodicals. Contains brief descriptions, prices, and order forms.

For your free copy, write or call:

American Geophysical Union
2000 Florida Ave., N.W.
Washington, DC 20009

Attn: Marketing Dept.

(800) 424-2485

GAP

Separates

To Order: The order number can be found at the end of each abstract; use all digits when ordering. Only papers with order numbers are available from AGU. Cost: \$3.50 for the first article and \$1.00 for each additional article in the same order. Payment must accompany order. Deposit accounts available.

Send your order to:
American Geophysical Union
2000 Florida Avenue, N.W.
Washington, D.C. 20009

Mineralogy, Petrology, and Crystal Chemistry

4350 Parameters, petrology, and petrochemicals: A REVIEW OF REACTION PROCESSES AND AN EXPERIMENTAL MODEL FOR THE HIGH-TEMPERATURE METAMORPHISM OF BASIC ROCKS. J. M. Ferry (Department of Geology, Arizona State University, Tempe, Arizona 85287).

A general method is presented by which the composition of phases in metamorphosed igneous rocks can be used to quantitatively measure the progress of observed reaction which proceeded during metamorphism. The method is applied to the experimental hydrothermal equilibrium study of a mid-ocean ridge tholeiite by Spear (1981), and metamorphism of rock by a variety of processes is modeled at temperatures between 600° and 800°C. (a) Isobaric contact metamorphism at buffered oxygen fugacity; (b) isobaric metamorphism with increasing pressure at buffered oxygen fugacity; (c) metamorphism along a "normal" and a "low" geothermal gradient at buffered oxygen fugacity; (d) isobaric metamorphism with increasing temperature; (e) isobaric metamorphism with increasing temperature and increasing pressure; (f) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure; (g) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (h) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (i) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (j) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (k) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (l) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (m) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (n) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (o) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (p) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (q) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (r) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (s) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (t) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (u) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (v) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (w) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (x) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (y) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (z) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (aa) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ab) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ac) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ad) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ae) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (af) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ag) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ah) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ai) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (aj) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ak) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (al) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (am) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (an) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ao) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ap) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (aq) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ar) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (as) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (at) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (au) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (av) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (aw) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ax) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ay) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (az) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ba) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bb) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bc) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bd) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (be) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bf) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bg) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bh) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bi) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bj) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bk) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bl) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bm) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bn) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bo) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bp) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bq) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (br) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bs) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bt) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bu) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bv) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bw) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bx) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (by) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (bz) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ca) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cb) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cc) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cd) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ce) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cf) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cg) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ch) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ci) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cj) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ck) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cl) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cm) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cn) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (co) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cp) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cq) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cr) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cs) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ct) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cu) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cv) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cw) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cx) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cy) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (cz) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (da) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (db) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dc) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dd) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (de) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (df) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dg) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dh) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (di) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dj) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dk) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dl) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dm) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dn) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (do) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dp) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dq) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dr) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ds) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dt) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (du) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dv) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dw) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dx) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dy) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (dz) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ea) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (eb) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ec) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ed) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ee) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ef) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (eg) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (eh) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ei) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ej) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ek) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (el) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (em) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (en) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (eo) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ep) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (eq) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (er) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (es) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (et) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (eu) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ev) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ew) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ex) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ey) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ez) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fa) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fb) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fc) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fd) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fe) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ff) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fg) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fh) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fi) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fj) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fk) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fl) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fm) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fn) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fo) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fp) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fq) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fr) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fs) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ft) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fu) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fv) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fw) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fx) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fy) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (fz) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ga) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gb) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gc) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gd) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ge) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gf) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gg) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gh) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gi) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gj) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gk) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gl) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gm) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gn) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (go) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gp) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gq) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gr) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gs) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gt) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gu) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gv) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gw) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gx) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gy) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (gz) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ha) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hb) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hc) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hd) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (he) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hf) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hg) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hh) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hi) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hj) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hk) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hl) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hm) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hn) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ho) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hp) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hq) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hr) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hs) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ht) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hu) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hv) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hw) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hx) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hy) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (hz) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ia) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ib) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ic) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (id) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ie) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (if) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ig) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ih) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ii) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ij) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ik) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (il) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (im) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (in) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (io) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ip) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (iq) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ir) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (is) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (it) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (iu) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (iv) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (iw) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ix) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (iy) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (iz) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ja) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jb) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jc) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jd) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (je) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jf) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jg) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jh) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ji) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jj) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jk) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jl) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jm) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jn) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jo) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jp) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jq) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jr) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (js) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jt) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ju) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jv) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jw) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jx) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jy) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (jz) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ka) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kb) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kc) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kd) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ke) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kf) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kg) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kh) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ki) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kj) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kk) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kl) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (km) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kn) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ko) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kp) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kq) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kr) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ks) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kt) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ku) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kv) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kw) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kx) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ky) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (kz) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (la) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lb) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lc) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ld) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (le) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lf) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lg) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lh) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (li) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lj) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lk) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ll) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lm) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ln) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lo) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lp) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lq) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lr) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ls) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lt) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lu) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lv) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lw) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lx) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ly) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (lz) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (ma) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (mb) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (mc) isobaric metamorphism with increasing temperature and increasing pressure and increasing pressure and increasing pressure; (md) isobaric metamorphism with increasing temperature and increasing